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Worldwide Report

NUCLEAR DEVELOPMENT AND PROLIFERATION

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WORLDWIDE REPORT

NUCLEAR DEVELOPMENT AND PROLIFERATION

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[Article by Stefan Marcin, Research Institute of the Fuel and Energy Complex, branch in Bratislava: "Selected Applications of Computation of the Fuel Component of Generating Costs in Nuclear Power Plants"]

[Text] This article provides information about the peculiarities of computation of the fuel component of generating costs in nuclear power plants. It offers a brief outline of some of the approaches to the methodology of assessing the fuel component.

1. Introduction

In comparison to conventional power plants, the determination of the fuel component of generating costs in nuclear plants (JE) is marked by some technical peculiarities due primarily to the different operating mode of JE's and to the properties of nuclear fuel.

Methods for computation of the fuel element have been dealt with by many authors and there are several approaches to solving the problem. This is reflected also in the fact that varying methods are used for determining and accounting for the costs of nuclear fuel in different countries, even in individual JE's. The complex nature of this computation is given by the uncertainties regarding the length of reactor run and fuel cycle, the extent of fuel deterioration, the mode of partial substitutions of fuel elements, the potential for recycling spent fuel, etc.

From the viewpoint of a method of computing the fuel component of generating costs in JE's, importance also accrues to the economic nature of the fuel charge. To this day there is no consensus on classifying it sub capital assets or sub working capital. The economic nature of the fuel charge in JE's is not just a theoretical problem, but is also of great practical importance from the viewpoint of the method for computation of the fuel component.

In general it is true that fuel for energy generation purposes is a working asset. Contrary to conventional fuels that transfer their value in the process of generating electric power, or heat supply, simply into final

product and change their natural form, the fuel charge in JE's is marked by certain specifics that are characteristic of capital assets. For JE's using PWR-type reactors it represents a long-term fuel cycle--approximately 3 years-- and, after burning out, retention of natural form in the form of fuel sets with a still relatively considerable energy content of U 235 and newly generated isotopes of plutonium (239 through 242).

Another problem affecting the method used for computation of the fuel component of generating costs is evaluation of U 235 and of plutonium isotopes in the spent fuel, i.e., assessment of the fuel component in an open or in a closed fuel cycle.

The lack of consensus in viewing the economic nature of the fuel charge in JE's is also reflected in studies [1, 2]. The author of article [1] is of the opinion that the fuel charge in a JE that operates with an open fuel cycle, i.e., without reprocessing of spent fuel, must be regarded as a capital asset, because its inclusion in working capital, among other negative aspects from the viewpoint of financing, would cause difficulties in devising a methodology for determining the fuel component.

According to [2] and some other authors who chosse a compromise approach, the fuel element has the nature of a capital asset as well as of working capital. They are of the opinion that the portion of the initial charge which provides for the critical state of the reactor during nominal operational specifications becomes transformed into the price of electric power generated during the prescribed term for depreciation of investment in the power engineering sector. This portion is included in the fixed component and is proposed variously by different authors: 2/3, 5/6, and the entire initial charge.

Fuel that provides a supply of reactivity for the operation of the reactor between two exchanges is transferred fully to the costs of electric energy generated during the reactor run.

A shortcoming of the above-mentioned methodology is the fact that fresh fuel cassettes included in the n-th charge operate in the active zone for two to three reactor runs, but their price is transferred only to the generation of electric energy in the n-th run. This, coupled with changes in the length of runs for operational reasons, leads to incorrect values of the fuel component of generating costs.

The difficulties constituted by varying economic conditions of different countries have made the devising of a uniform methodological principle for computation of the fuel component impossible for the time being, even though MAAE has made considerable efforts in this direction.

In the subsequent text we shall concentrate on a brief description of selected approaches to the methodology for the computation of the fuel component of costs in various countries.

2. Approach to Methodology of Fuel Component Assessment of Costs in JE's.

2.1 Method Used in United States

Organizations operating JE's in the United States finance costs in all stages of the fuel cycle. The price of fuel going through individual stages of a closed fuel cycle represents working capital for entrepreneurs. The method for computation of the fuel component in the United States is based, among other things, on the assumption that fuel elements which at the end of a reactor's service life have not been fully utilized are recycled and the obtained uranium and plutonium are sold. This does away with the necessity for accumulating financial means toward the end of a reactor's service life for replenishment of the entire fuel charge.

Fuel costs incorporated into the price of electric power consist of the difference between the price of fresh and the "net" price of spent fuel elements, fees for fuel charge rental, including fuel in the reactor's active zone, in storage, and in the decomposition stockpile, taking into consideration its duration in each of these stages [3].

Determination of the mentioned expenditures represents a relatively complicated operation consisting of computation of components for individual stages of the fuel cycle that take into consideration due dates for payments and obtained credits. Special procedures and computation programs were developed in the United States that are used in the computation of the fuel component.

Computation of the fuel component in standard form is done in accordance with equation (1)

$$S_p = \frac{\{(C_N + C_V) - [C_Z + C_P - (Z_{Ch} + Z_{T_r} + Z_N)]\}.10^2}{24\ W.\eta.10^3} + \\ + \frac{i_N \frac{1}{2}\left[(C_N + C_Z) + \frac{t_{zds}}{t_R} C_V + \frac{t_V}{t_R} C_Z\right].10^2}{\bar{p}h\eta} \quad [\$/\text{kW.h}], \tag{1}$$

where

C_n -- costs for rental of uranium in a volume sufficient for the initial reactor charge [$/kg U],

C_v -- costs for production of fuel cassettes, including transportation, losses in production and percentual contributions for rental of uranium of the given degree of enrichment found in the stage of production and transportation [$/kg U],

C_z -- price of residual uranium in spent fuel elements after deduction of losses in recycling and conversion to UF_6 [$/kg U],

C_p -- price of plutonium contained in spent fuel elements after deduction of losses in recycling and conversion to metallic plutonium [S/kg U],

Z_{ch}-- costs for chemical recycling of spent fuel elements [$/kg U],

Z_{tr} --costs for transportation of spent fuel elements from JE site to the recycling plant [$/kg U],
Z_n --percentual contributions for credit extended to the JE for the period during which uranium is in transportation and recycling [$/kg U],
t_{zds}--supply of fuel sets in JE expressed in number of days of supply [d],
t_v --duration of which spent fuel elements were kept in the decomposition container [d],
t_R --median duration spent by fuel elements in the reactor [d],
$-_p$ --median nominal thermal load [kW /kg U],
W --median extent of fuel burnout in stationary mode [MWd/kg U],
η --net efficiency of the block,
h --maximum possible number of hours for utilization of installed capacity [h],
i_N --determined rental fee norm.

The first term of equation (1) denotes the part of the fuel component that includes the price of unspent U 235 and the recovered Pu 239. The second term denotes the rental fee for working capital required for providing the JE with uranium in the following fuel cycle stages:

--in the reactor's active zone--C_N,

--in the reprocessing cycle--C_Z,

--in stockpile--$C_v t_{zas}/t_R$,

--in decomposition container $C_Z t_V/t_R$.

The coefficient 1/2 in the numerator of the second fraction of equation (1) denotes the value of working capital required for the payment of interest for rental of uranium in the specified volume.

2.2 Methods Used in Other Western Countries

The system for financing the cost of nuclear fuel in other Western countries is different. An organization operating a JE finances only the cost of fuel sets on JE premises. The capital invested in the initial fuel charge figures, as a rule, as a long-term production asset. To achieve complete replenishment of the fuel charge, depreciation for its restoration is included in the generating costs [3] in these countries.

In Great Britain, organizations operating JE's buy finished fuel elements and sell spent elements for predetermined prices, depending on the extent of burnout. Herein the price of burnt-out fuel sets represents credit.

The following are included in the price of electric power:

--the difference between the price of fresh and spent fuel elements;

--annual costs attendant to annual payments from the price of fuel in the active zone, in stockpile and in the decomposition container;

--depreciation write-offs of the price of the initial fuel charge.

Computation of the fuel component is carried out in accordance with equation (2):

$$S_p = \frac{C_p - C_r}{24W} + \frac{i\left[C_p\left(G_{AZ} + \frac{t_{zds}}{12}G_R\right) + C_V\frac{t_V}{12}G_R\right]}{Nh} + \frac{C_l G_{AZ}(1-i)^T - 1)^{-1}}{Nh}, \quad (2)$$

where

C_p -- price of fresh (finished) fuel elements [S/kg U],

C_v -- price of spent fuel elements in stationary mode [S/kg U],

i -- interest rate,

G_{AZ}-- fuel charge in reactor [kg U],

G_R --annual fuel consumption [kg U/r],

t_{zds}-supply of fuel elements in JE expressed in number of months [mes],

t_v -- time for which spent fuel elements were held in composition container [mes],

W -- median extent of fuel burnout in stationary mode [kWd/kg U],

N -- electric power output [kW],

η -- net efficiency of the block,

h -- maximum potential hours of JE operation per hear [h/r],

T -- anticipated service life of the reactor [years].

In Austria, as far as capital relevant to fuel is concerned, it is assumed that the permanently required fuel charge (initial charge in the active zone) exists throughout the entire service life of the JE and subsequent charges involve only the substitution of fuel spent for the routine generation of electric power. The computation consists of two components. The first component includes costs of the initial charge (depreciation, interest, taxes).

The second component includes the costs of partial substitutions. Some enterprises in the FRG consider nuclear fuel to be capital assets.

However, for the purpose of uniformity, the Federal Ministry of Finance made it mandatory to include the fuel costs of JE's in company balance sheets sub working capital.

2.3 Method for Assessment of the Fuel Component of Generating Costs in WWER JE

In the CSSR, costs of initial fuel charges (heading XI of budgeted costs) and costs for fuel introduced into reactors during substitutions after runs are met from operational costs.

At the present time it is not clear how the computation of the fuel component is to include the contents of U 235 isotopes and of plutonium in spent fuel, and costs for storage and recycling.

One of the possible methods for computing the fuel component of generating costs in JE's of the WWER type is the one the basic of which are described in [4]. This method is based on the following assumptions:

a) known costs of fresh fuel cassettes;

b) total time for which fuel cassettes were kept in the reactor's active zone -- fuel cycle;

c) effective duration of reactor runs given by the neutron-physical characteristics of the fuel contents that are updated prior to every run;

d) spent fuel taken out of the reactor has a zero value, i.e., its price during the generating cycle, fuel cycle, became completely transferred to the final product, in the case the generated electric energy, or heat supply.

Then the part of acquisition costs for fresh fuel cassettes, with overall time spent in the active zone through three reactor runs, which for one reactor run is transferred into the final product, is computed in accordance with the following equations:

a) for the first reactor run

$$N_{K1} = N_{P1} \frac{T_{c/1}}{T_{c/1} + T_{c/2} + T_{c/3}}; \qquad (3)$$

[Kcs/run]

b) for the second reactor run

$$N_{K2} = N_{P1} \frac{T_{ef2}}{T_{ef1} + T_{ef2} + T_{ef3}} + \\ + N_{P2} \frac{T_{ef2}}{T_{ef2} + T_{ef3} + T_{ef4}}; \tag{4}$$

[Kcs/run]

c) for the third (m-2) reactor run; i = 3 ÷ (m - 2)

$$N_{Ki} = N_{Pi-2} \frac{T_{efi}}{T_{efi-2} + T_{efi-1} + T_{efi}} + \\ + N_{Pi-1} \frac{T_{efi}}{T_{efi-1} + T_{efi} + T_{efi+1}} + \\ + N_{Pi} \frac{T_{efi}}{T_{efi} + T_{efi+1} + T_{efi+2}}; \tag{5}$$

[Kcs/run]

d) for (m - 1) reactor run, i = (m - 1)

$$N_{Ki} = N_{Pi-2} \frac{T_{efi}}{T_{efi-2} + T_{efi-1} + T_{efi}} + \\ + N_{Pi-1} \frac{T_{efi}}{T_{efi-1} + T_{efi} + T_{efi+1}} + \\ + N_{Pi} \frac{T_{efi}}{T_{efi} + T_{efi+1}}; \tag{6}$$

[Kcs/run]

e) for m-th, last reactor run, i = m

$$N_{Ki} = N_{Pi-2} \frac{T_{efi}}{T_{efi-2} + T_{efi-1} + T_{efi}} + \\ + N_{Pi-1} \frac{T_{efi}}{T_{efi-1} + T_{efi}} + N_{Pi}; \tag{7}$$

[Kcs/run]

where

T_{eji} --is effective length of i-th reactor run [effective day],

N_{Pi} --costs of fresh fuel introduced into the active zone during the i-th reactor run [Kcs],

N_{Ki}--fuel component of costs transferred to the final product per reactor run [Kcs/run].

For the fuel that remains in the active zone forless than three runs, i.e., two or a single reactor run, we obtain analogous relations by a simple modification.

The import of equations (3) through (7) can be explained by means of equation (5). As can be seen from Figure 1, fuel introduced into the reactor in i--the second run (i.e., cost N_{Pi}-2) figures in generation of electric (thermal) energy for three reactor runs (i.e., in i-2, i-1, i-th run). Then the commensurate part of costs for fresh fuel introduced in the i-2 reactor run is

$$N_{Pi-2}\frac{T_{efi}}{T_{efi-2}+T_{efi-1}+T_{efi}}. \qquad (8)$$

Similar import also applies to other terms of equation (5). By summation of all the three terms of this equation we arrive at the fuel component of costs in the i-th run.

The fuel component of [a JE's] own costs of generating electric (thermal) power computed according to relations (3) through (7) is related to reactor runs. If the beginning and end of a reactor run coincides with the beginning and end of a calendar year, then the thus computed fuel component represents at the same time the annual component of generating costs. In the case where the beginning of the reactor run occurs during one year and the end of the run in the subsequent year, the annual fuel component of generating costs is computed as the sum of shares of reactor run fuel components depending on the number of effective days of any given run falling into a given year.

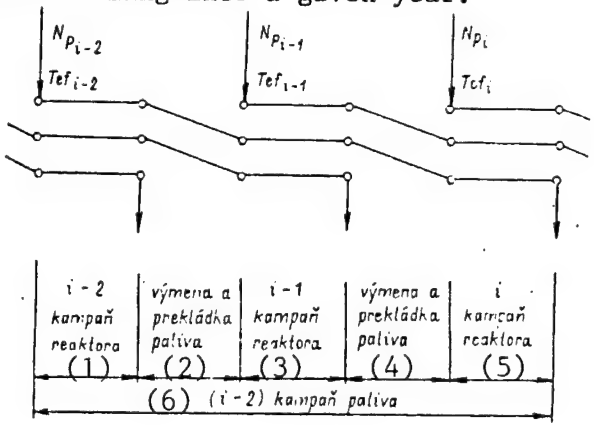
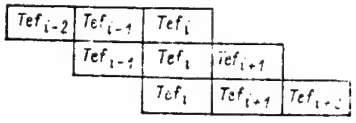


Figure 1. Schematic Representation of fuel progression through reactor and transfer of its value into the electric power generated in the 1-th reactor run.
Key:
(1) i-2 reactor run
(2) fuel substitution and transfer
(3) i-1 reactor run
(4) fuel substitution and transfer
(5) i reactor run
(6) fuel cycle



A similar methodology is used in determining the fuel component from [the JE's] own cost of generation of electric power and of heat supply from the beginning of operation of the 1st and 2nd block of the JE V 1 in Jaslovske Bohunice.

3. Conclusion

It can be stated in general that the approach to the assessment of the fuel component of costs lacks uniformity. The selection of a method is determined by whether it applies to the assessment of a closed or an open fuel cycle.

In order for the fuel component of generating costs to reflect reality, the method employed must take into consideration the transfer of costs of fresh fuel to the generated electric power, or heat supply, in relation to the contribution made by the assessed fuel not only to the reactor run, but also to the fuel cycle. Relations (3) through (7) take this fact into consideration and the method applied can also be to other fuel cycle periods.

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DEVELOPMENT OF NUCLEAR POWER, PHYSICS OUTLINED

Zarnowiec Nuclear Power Plant

Warsaw TRYBUNA LUDU in Polish 1 May 84 p 4

[Article by Zbigniew Wrobel: "An Example of Polish-Soviet Collaboration: The Zarnowiec Nuclear Power Plant"]

[Text] The world's energy needs double every 10 years. The conventional power industry, which is based primarily on oil and coal, is not able to maintain such a tempo. The future lies with energy production technology that uses nuclear fuel. Presently 300 power reactors are operating in the world, and an additional 160 are under construction.

Poland started work on outlining a path to develop a nuclear power industry relatively quickly but began to realize its first investment relatively late. Poland's first nuclear power plant has been under construction at Lake Zarnowiec for 2 years now. According to the assumptions, it will generate 1,860 MW and consist of four power units. In realizing and equipping this investment, Poland's power industry is making extensive use of the Soviet Union's achievements and experiences.

"Countries of our size and our economic potential," says Engineer Lech Hryckiewicz, director of the Zarnowiec Nuclear Power Plant under construction, "are in no position to develop nuclear power technology independently. They must make use of the technical and conceptual help of the experienced countries that have highly developed design and production potential in this area. For Poland, the Soviet Union is a natural and the best partner."

All in all, the Soviet Union is helping a large group of countries to develop a nuclear power industry: Czechoslovakia, Hungary, the GDR, and Finland. Soviet nuclear technology encompasses all the criteria for moderninty: it has many years of experience, the technology is safe and, at the same time, economical in operation. The first Polish atomic power plant will be equipped with a VVER-440-type reactor, which is absolutely reliable, efficient and especially suited for training a cadre of specialists.

"We are offering our achievements and experiences in this area of nuclear technology to Poland's power industry and to the builders of the Zarnowiec power plant," says Semion Astashkevich, a member of the group of Soviet specialists delegated to help build the power plant. "April marked the first anniversary of the signing by the Polish and USSR governments of the agreement on cooperation to build the first Polish nuclear power plant. The Soviet Union will supply the documentation, technical help and materials. After the power plant is built, we will guarantee its safe operation, and we will supply the nuclear and remove the spent fuel because Poland does not have the capability to reprocess the fuel."

Specialists from Leningrad and Odessa are now helping with the construction of the Zarnowiec power plant, and these experiences will also be useful in the future when Poland builds subsequent nuclear power plants.

Atomic Physics Achievements, Problems

Warsaw RZECZOSPOLITA in Polish 19 Jun 84 p 2

[Article: "Polish Achievements and Problems in Atomic Physics"]

[Text] Despite serious economic difficulties, Poland is achieving significant results in atomic physics on a national scale.

Mieczyslaw Sowinski, chairman of the State Atomic Physics Agency, said that Poland's most important achievement in atomic physics in the latest period is the initiation of production of an internal-core control system for the VVER-440 nuclear power reactor called the Hindukusz.

The first computer system designed to aid the dispatcher for the 360-MW power unit has been produced and placed into operation at the Belchatow power plant. This year more such systems will be produced. Six Neptun 10p therapeutic accelerators have also been produced, of which three were delivered to Polish oncology centers.

Production of the Sejwal dosometer measurements system for nuclear power plants is continuing. The completion of a prototype 4-MEV Limex therapeutic accelerator, which is a substitute for the imported so-called cobalt bomb, puts us in second place among the CEMA countries after the USSR in this area.

In speaking about the successes that were achieved under very difficult circumstances, one should not forget the factors that are impeding the development of this branch of science and technology that is modernizing many areas of our life. Thes impediments include the use by many managers in the process of organizing training and production of old methods of action and ways of thinking that are not in keeping with the economic reform.

The high degree of waste of production potential is a serious impediment in the operations of Poland's atomic physics units.

The main reason for this state of affairs is the many years of underfunding of investments, especially for essential purchases from the highly developed capitalist countries. The organization of innovative activity and the poor status of the technical base for the production of isotopes and the neutralization of radioactive wastes is also unsatisfactory.

At the 18 June meeting of the State Council on Atomic Physics, which was chaired by Prof Jerzy Minczewski, the participation of Polish atomic physicists in preparing the Third Congress of Polish Science was discussed, among other things.

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NUCLEBRAS DEBT RISES TO $2.2 BILLION; COMMENT

Rising Debt

Sao Paulo O ESTADO DE SAO PAULO in Portuguese 10 Jun 84 p 50

[Text] NUCLEBRAS [Brazilian Nuclear Corporations, Inc] will have to borrow US$330 million this year and has already borrowed US$170 million recently from England and Germany. Thus its foreign debt is nearly US$2.2 billion. It will pay US$200 million this year in finance charges and interest to service the debt, plus US$55 million in payments on loans already due, according to the finance director of that enterprise, Wenceslau D'Avila Fernandes Magalhaes.

The finance director of NUCLEBRAS does not think any magic is involved in obtaining loans, even under the current circumstances, in which Brazil is considered by international bankers to be a major risk and the nuclear program, an even greater one. This is because, in reality, the credit has already been granted to the Central Bank at the time of the negotiation of Phase 1, when Brazil received a jumbo loan of US$4.4 billion.

That money went to the Central Bank as the borrower, with the Uniao [bank] as guarantor. Bankers are not fundamentally interested in the project itself but rather in the borrowing country, according to Wenceslau Magalhaes. For foreign banks it is much more beneficial to disburse the loan, changing the borrower from the Central Bank to NUCLEBRAS, because they gain from the income tax that Brazilian enterprise must pay at 12.5 percent and from other expenses connected with the signing of the loan. Furthermore, the risk remains the same because the Uniao is still the guarantor.

According to Wenceslau Magalhaes, 30 June is the deadline for disbursing to state enterprises the funds from the jumbo loan negotiated in late 1983 during what is known as Phase 1 of the negotiations with the international financial community. Then the agreements will go into effect of the Phase 2 disbursements of a jumbo loan of US$6.5 billion. At that point NUCLEBRAS hopes to negotiate another US$20 to US$30 million with a consortium of banks led by EUROBRAS and between US$100 and US$110 million from another consortium led by Commerze Bank of Germany. Actually, says the director of NUCLEBRAS, those contracts are a mere formality because the dollars have already been lent to the Central Bank.

NUCLEBRAS' overall foreign debt is divided between US$1.3 billion in common currency loans and US$900 million in supplier's credits. The entire debt was contracted with German banks as part of the negotiations for the nuclear agreement and it basically finances exports of goods and services produced in that country. Added to this debt is another US$1.7 billion in open lines of credit, which are guaranteed through trade agreements.

Thus there is a US$200 million line of credit with England for the purchase of uranium enrichment services in URENCO, a US$10 million line of credit with France for the purchase of equipment and technology for the Yellowcake Industrial Power Plan at Pocos de Caldas and 3 more lines of credit under the nuclear agreement with Germany for the purchase of the power plants of Angra 2 and 3 (US$1.37 billion), for the enrichment process (US$87 million) and for reprocessing (US$50 million).

Adding up the sum already borrowed abroad, US$2.2 billion, and another US$1.717 billion negotiated and guaranteed through trade agreements, it may be said that the total foreign debt of NUCLEBRAS is almost US$4 billion. However, Wenceslau Magalhaes explains that the use of that US$1.717 billion will depend on the speed of the projects in the nuclear program, whatever the debt assumed may be. In a projection of the US$2.2 billion debt, the debt service and payments--assuming no increase, which is impossible--will be US$353 million next year, US$418 million in 1986, US$529 million in 1987, US$531 million in 1988, US$410 million in 1989, US$425 million in 1990, US$303 million in 1991, and US$245 million in 1992, with successive decreases until the year 2003, supposing that the original debt does not increase.

According to Wenceslau Magalhaes, NUCLEBRAS' budget for this year is 1.74 trillion cruzeiros. When the nuclear program began, he explained, the proportion of the input of national resources was US$1 in financing for German exports. When the program slowed down that proportion became US$4 borrowed abroad for US$1 contributed by the Brazilian government.

Time to Return the Favor

Sao Paulo O ESTADO DE SAO PAULO in Portuguese 12 Jan 84 p 3

[Commentary] NUCLEBRAS is continuing to obtain loans in order to pay some of the interest on its foreign debt, currently estimated at US$2.2 billion. This amount will increase to US$4 billion, taking into account the new trade packages already negotiated with German banks. A large part of the current debt is due not to equipment for the enrichment cycle or reprocessing of uranium but rather to the purchase, in Germany, of reactors for the power plants of Angra 2 and 3, the construction of which was, in principle, delayed by the government. Of that total, at least US$1.37 billion is earmarked for this purpose; that is, for the purchase of units that are already being sent to Brazil but which will not be installed before 1990. Consequently, this equipment will remain in storage for some years, threatened by corrosion or the loss of guarantees.

The industrialists and government of the Federal Republic of Germany do not want to acknowledge the problem, which is Brazil's, not theirs. They have little interest in whether Brazil has postponed its program or not, whether it has enough cruzeiros to carry out some of its civil works or whether the government should postpone them for some time, given the financial situation of the country and the need for nuclear power until at least the end of the decade. The loans were drawn up and signed by then Minister of Mining and Energy Shigeaki Ueki in such a way that it is impossible to escape the commitment assumed. We have to continue to buy and to request loans from the German banks in order to pay for the reactors supplied by German industry.

According to the finance director of NUCLEBRAS, Wenceslau D'Avila Fernandes Magalhaes, the company will have to raise another US$300 million this year, which is easy, since the committments have already been agreed upon with the German banks. What the director of NUCLEBRAS does not reveal is how much farther Brazil will continue to go into debt because of a nuclear program acknowledged as postponable by President Figueiredo himself. It is known that another US$1.7 billion will be abasorbed, increasing the company's debts to US$4 billion, on which there is a commercial interest of over 12 percent per year. This is in addition to the spreads, commissions and other charges that considerably raise the cost of this money, which was only borrowed to meet commitments that are condemned by the current government!

This is a strange, aberrant situation which should be changed by means of a complete revision of an agreement that is harmful to national interests. The country cannot assume more debts for postponable projects, even if it has commitments to foreign governments. The Brazilian government should completely revise the nuclear program, in a real way, negotiating with the Federal Republic of Germany different terms for its execution. We understand that there are signed trade contracts; but there are also ties of friendship between the two countries that should be invoked in the new negotiations.

Finally, German industries profited nicely from the previous agreement, and Brazil is duly fulfilling its commitments, even with the onus of a debt on the order of billions of dollars. This situation simply cannot go on, especially because the minimum resources are not available for carrying out more urgent projects, such as completing hydroelectric power plants and their lines of transmission, which cannot stand any more delays.

The Brazilian government must renegotiate the nuclear agreement, and the Federal Republic of Germany should now demonstrate friendship and understanding. We would almost say "gratitude" because the Brazilian countracts, signed in 1975, were what saved the nuclear industry of that country from a grave economic crisis.

The time has come to return the favor, which is now costing us US$4 billion.

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CSO: 5100/2111

ANGRA DEFECT MAY CAUSE PROLONGED DELAY IN OPERATION; COMMENT

Defect Another Possible Error

Sao Paulo O ESTADO DE SAO PAULO in Portuguese 26 Jun 84 pp 35

[Text] With a budget of $313 million when the construction of the nuclear plant of Angra I was started, 12 years ago, it is already costing $1.8 million today. But there is a possibility that the construction will have to be halted for a long time if Westinghouse confirms that the defect in the recharging pump is another project error and not a simple mechanical problem.

This was revealed by Furnas chairman, Licinio Seabra, who during an exclusive interview with ESTADO/JT yesterday in Rio de Janeiro said that the defective parts of the recharging pump are being replaced and that the conclusion of the repair is scheduled for 25 July. Beginning then Furnas is expected to place the Angra I nuclear plant into full operation with 100 percent of its installed capacity to operate in this manner for 2 months without interruption. If there are no other defects, the plant will begin commercial operation in October.

In the meantime, Furnas did not identify the causes for the breakdown of the recharging pump and admits that the Westinghouse report points to a new error in the preparation of the project, as has already happened twice before with the defects in the steam generator and in the thermal sleeves, parts that also had to be replaced. Assuming that the error of the project is confirmed, various valves will have to be changed and the systems will have to be readapted, requiring a period of stoppages still not estimated by Furnas.

Licinio Seabra commenting on the possibility of a long stoppage, touched wood and said that everything in life depends on a little luck and Angra I needs it. He explained that the pump is important for the security system of the plant because it serves to remove and pump the water of the primary circuit when the chemical and volumetric control is made of radioactive water that passes in the closed circuit of the primary refrigeration system. This water is removed to be purified with washes of resins to eliminate the excess of boron, an element that serves as moderator, and to deactivate the core of the reactor.

Seabra recalled that the construction of Angra I started in 1972 and that its initial price was $500.00 per nuclear kilowatt. Now the price is $2,800 per nuclear kilowatt, with a debt of $1.8 billion still to be paid. This debt represents $300 million (suppliers credits) with the Eximbank--which heads a consortium of U.S. banks such as Bankers Trust, Morgan, and others--plus $750 million borrowed by Eletrobras [Brazilian Electric Power Companies, Inc.] in currency on the international market, plus $750 million in cruzeiros borrowed on the domestic market by Eletrobras.

The Furnas chairman said that the interests paid to Eximbank are still based on 9 percent per annum, but that Eletrobras is paying interest of 15 percent on its loans made by Resolution No 63 and collects monetary correction plus interest on its loans in cruzeiros.

In this manner Furnas pays an average of over 12 percent in interest a year and the nuclear plant has not operated for 2 years because in 1981 the reactor core was loaded and, at last, after 3 months of testing for commissioning it was to begin commercial operation. The loading of the core is the same operation as filling an auto with gasoline to drive it away when we buy it from a dealer.

During these 2 years the breakdowns because of mechanical defects and because of errors in the planning of the project by Westinghouse, substantially increased the cost of the plant. This, in addition to the fact that when it was built, the duration of the construction was estimated in 5 years. After 12 years, a negative record in world terms, there is no indication as to when Angra I is going to operate.

Direction of Nuclear Program Unclear

Sao Paulo O ESTADO DE SAO PAULO in Portuguese 27 Jun 84 p 3

[Commentary]

[Text] The fact that the Angra dos Reis plant may not operate for an indefinite period illustrates perfectly well the Brazilian nuclear program: increasingly expensive and, above all, nonessential. Angra I has been showing successive defects not corrected by its U.S. supplier. The work on Angra II and III is several years behind, but the entire project continues to consume endless resources. Last week the chairman of Nuclebras [Brazilian Nuclear Corporation, Inc.], Dario Gomes, confirmed that the program has absorbed $4 billion and that the final cost will be $18.6 billion, to which an amount, not revealed but which can be imagined, is to be added covering interests on debts contracted for the construction. On the other hand, a forecast that we made some time ago that the Brazilian nuclear program will absorb some $30 billion, although somewhat diminished, has been confirmed.

The government does not know what to do with Angra I, with the equipment and plans totally supplied by a U.S. firm, or with the four plants purchased in Germany, two of which have already been built and are being turned over

to Brazil. There are no resources for civilian projects and even now, the Nuclebras is asking the Ministry of Planning for 200 billion cruzeiros more to complement its budget of 1,740 billion cruzeiros. All this, it should be said, all this money to maintain work at a slow pace, with the expectation of a delay of at least 5 or 6 years.

The Nuclebras chairman confirmed that this year loans for $330 million will be raised abroad, essentially to pay the interests on debts and commitments assumed by the firm. In sum: almost 2 trillion cruzeiros and another $330 million will be needed in order not to let die the grandiose Brazilian nuclear program that was intended to be one of the largest in the world....

It is not known how big will become the snowball which is rushing to the precipice of insolvency. But it is known, through interview with those responsible for this plunder, that no one in the government has a solution for this situation. No one knows what to do with the Brazilian nuclear program, and while no solution is found, it continues to absorb the scarce resources that are needed to carry out important and priority projects, or to take care of health, education and social welfare.

After a period of silence and caution which dominated the sector, now begin to appear errors made in the approval, unjustifiably hasty, of a timetable for costly and unnecessary projects which are burdening national economy. The diagnosis was made by the present administration: the agreement is impractical and was courageously reviewed against the pressure of military sectors who insisted on its full execution. However, would this evaluation be sufficient? Or should the country continue the nuclear program?

These questions must be asked by responsible authorities who cannot continue burdening the country with the exaggerated weight of ill-conceived projects. There must be a solution that does not cost us 2 trillion cruzeiros per year and $330 million taken abroad for absolutely nothing.

Today, when talk about the nuclear agreement is no longer an attack on national security, the impression one gets is that neither Minister Cesar Cals, nor the Nuclebras chairman, nor even the military who are involved, know what to do with it. Then why not create a high-level commission, with the participation of the Brazilian scientific community, with the professors who were always kept away from the decisionmaking and opinionmaking forums, to review democratically what was done and to propose solutions acceptable to the nation? In the final analysis, it is the interest of the country that must predominate and not the German industry of nuclear construction!

11634
CSO: 5100/2116

LATIN AMERICAN 'DENUCLEARIZATION' SEMINAR HELD

Physicist Addresses Seminar

PY091623 Sao Paulo FOLHA DE SAO PAULO in Portuguese 8 Jul 84 p 23

[By reporter Paulo Marques]

[Text] Luis Pinguelli Rosa, a physicist atthe Rio de Janeiro University, affirmed yesterday that "Brazil has not yet built the atomic bomb due to the lack of capability of the military." According to Rosa, a parallel nuclear program is being developed in Brazil for the sole purpose of manufacturing atomic weapons. How else can "the obscure activities at the IPEN (Nuclear and Energy Research Institue of Sao Paulo and those at the ATC (Aeronautics Technical Center) of Sao Jose dos Campos be justified? Because we unquestionably know that the military is developing uranium enrichment program there, a process that will fatally lead to the manufacturing of atomic bombs."

This evaluation was made yesterday at the well-attended "Denuclearization of Latin America" seminar in which Mario Schenberg, physicist from theUSP (Sao Paulo University). Ernesto Gutierrez, ambassador of Nicaragua to Brazil, Betty Nutte, observer for the executive board of the U.S."American Friends' Service Committee", and Carlos Girotti of the National Research Council for Science and Technology of Argentina also participated.

Rosa noted that Argentina is also trying to gain the technological capability to build atomic bombs, "as a response to the arms race internally unleashed by the Brazilian military." According to Rosa, there is no excuse for Argentina going into uranium enrichment programs because its nuclear program is based on the operation of power reactors fueled with natural uranium -- like the Canadian and Indian nuclear programs -- not with enriched uranium "as is the case with the unsuccessful Brazilian Nuclear Program."

Physicist Rosa voiced this warning: "For that reason it is necessary to stand for the nuclearization [as published] of the entire Latin American Continent, because only this way can we be sure that we are not promoting an arms race."

The scientist of the University of Rio de Janeiro revealed his concern over the uranium enrichment program that is under way in Argentina, because it represents a risk even in the hands of democratic political regimes, like the one now headed by Alfonsin. The uranium enrichment technology was obtained by Argentina late last year when it announced having mastered the complete uranium cycle through gaseous diffusion. Rosa noted that "after all, it should not be forgotten that the first nuclear device was set off on the initiative of the U.S. democratic government at the end of World War II."

However, the most applauded speaker was Mario Schenberg who spoke of the dramatic effects of an eventual nuclear war "which will affect not only the warring countries, but the entire world and, consequently, mankind." Schenberg explained that the atomic mushrooms from nuclear explosions will send so much dust into the atmosphere that the light of the sun will be blotted out. A long nuclear winter would thus begin, and agriculture would be totally destroyed because of the low temperatures and the lack of photosynthesis, a function of plants that depends on the sun's heat and light.

The Nicaraguan ambassador, in turn, made a purely political pronouncement, affirming that there is no civil war in Nicaragua, "only the invasion of mercenary troops operating through Honduras and Costa Rica." Ambassador Gutierrez then stressed that "for peace to prevail in Central America, the United States should stop intervening in the region and, especially, cease sponsoring the criminal action of mercenaries at the service of the CIA."

Further Report

PY100230 Madrid EFE in Spanish 1959 GMT 9 Jul 84

[Text] Sao Paulo, 9 Jul (EFE) -- Sao Paulo University professor Luiz Carlos Menezes has stated that Brazilian military officers are firmly determined to build a nuclear bomb. With this statement, physicist Menezes is confirming another charge made last Saturday by professor Luiz Pinguelli Rosa of the Rio de Janeiro Federal University. However, Menezes stated that the Brazilian military officers have not yet reached their objective because of technical difficulties.

This information, published today in the newspaper FOLHA DE SAO PAULO, notes that, according to the physicists, the Sao Paulo Institute for Nuclear and Energy Research (IPEN) has been transformed into a studies and research center directed by the Brazilian Navy.

According to Menezes, "IPEN is virtually totally militarized in keeping with a process that has been expedited in the last few years." The Sao Paulo University physicist noted that "it is the Brazilian Navy's intention to produce a nuclear submarine as soon as possible." Menezes added: "But the important thing is not whether this objective is achieved within 3 or 10 years. What is important here is that the military is determined to produce nuclear war equipment and that it is spending a fortune for a despicable objective at a time when the majority of the popula ion is experiencing hardship."

Menezes said that the Air Force is carrying out similar experiments at the "Advanced Studies Center" of the "Aerospace Technology Center" (CTA), located in Sao Jose dos Campos in Sao Paulo.

According to the physicist, the Brazilian Air Force has at least 100 officers who are nuclear energy experts who have been trained abroad.

The Brazilian Navy and Air Force work is being backed by a large number of specialists who participate in these research programs, but they are obliged to keep their activities secret.

According to he Menezes, the specialists at the CTA have at their disposal an enormous data bank on nuclear material that is located "in underground shelters and it is not being used to build the first nuclear-powered plane in the world."

He said that a large part of the IPEN installations is off limits to even Sao Paulo University physicists and that they are guarded by security guards inside the institute.

The Sao Paulo University physicist stated: "I am not making any supposition that experiments are being carried out to build nuclear equipment in Brazil. I am saying that this is happening. There is no need to carry out any espionage activity, you just have to gather certain information that can be found here and there."

Physicist Mario Schenberg has reasserted his supprt for the use of nuclear energy for peaceful purposes and for the control of nuclear research programs by society through Congress.

Physicist Mario Schenberg has reasserted his support for the use of nuclear energy for peaceful purposes and for the control of nuclear research programs by society through Congress.

Physicist Roberto Huaki, who is also from Sao Paulo University, added that in addition to the normal risks that a program like this entails, "we must consider the enormous expense and the geopolitical impact that this program will have throughout the world and particularly in Latin America."

Spanish-speaking America is the only inhabited area of the earth that is protected by the "Tlaltelolco Treaty," which was signed in Mexico in 1967 and which restricts the use of nuclear energy for military purposes in the region.

CSO: 5100/2118

BRIEFS

SECOND YELLOW-CAKE PLANT SITE--Rio--The Brazilian Nuclear Corporation (NUCLEBRAS) is planning to build a second plant for yellow-cake (uranium concentrate used in the manufacture of fuel elements for nuclear plants) in Imbituba, Santa Catarina. This project is part of a broad transaction between that state enterprise and PETROFERTIL (a PETROBRAS subsidiary in the area of fertilizers) and the French Nuclear Materials General Company, which will be formalized by a letter of intent this month. NUCLEBRAS already has a uranium mining-industrial complex in Pocos de Caldas, NUCLEBRAS' idea is to transport the uranium from Itataia, in Ceara, to Imbituba, where the phosphoric acide, used as a raw material in the production of fertilizers, will be removed at the PETROFERTIL unit. In a pilot-plant the cost of which has been estimated at $14 million, 50 tons of uranium concentrate per year will be produced initially. Later, that amount will be increased to 2,000 tons per year. The agreement with the French company envisages the financing of the projects necessary for mining the uranium in Itataia and the pilot plant. In exchange, the company will receive the uranium concentrate. [Text] [Rio de Janeiro GAZETA MERCANTIL in Portuguese 21-22 Jun 84 p 10] 8711

NUCLEBRAS WAGE HIKES--NUCLEBRAS is readjusting the salaries of specialized technicians--mainly those who completed a training course in Germany--above the limits established by Decree-Law 2,065 but without exceeding the personnel budget limit set by the Planning Secretariat. According to the NUCLEBRAS office chief in Brasilia, Colonel Luis Francisco Ferreira, the company is readjusting its personnel budget since there were many resignations last year--approximately 500--and no one was contracted. Thus, depending on the availability of funds and, according to the position of the technician and the market, the salaries of specialized employees are being readjusted to prevent a mass exodus inasmuch as the private companies offer higher salaries. According to Colonel Ferreira, not all technicians are getting salary readjustments higher than the rates established by Decree 2,065. "In some cases, the readjustment judiciously follows the provisions of the law," he said, adding that various technicians were taking courses in Germany and when they returned got jobs in the private sector, even fulfilling the obligation of remaining 2 years in NUCLEBRAS. "With the salary of a technician who leaves, NUCLEBRAS can adjust the salary of four technicians who remain," explained Colonel Ferreira. [Text] [Sao Paulo FOLHA DE SAO PAULO in Portuguese 19 Jun 84 p 9] 8711

CSO: 2100/2117

COUNTRY'S NUCLEAR POWER PROGRAM TO ENTER SECOND PHASE

Bombay THE TIMES OF INDIA in English 11 Jun 84 p 8

[Text]

NEW DELHI, June 10 (PTI).

THE commissioning of a fast breader reactor (FBTR) at the reactor research centre (RRC), Kalpakkam, near Madras, towards the end of this year will mark the beginning of the second phase of the country's nuclear power programme.

An important feature of the FBTR projects is that construction of the reactor is essentially an indigenous effort. All the major components, like the reactor vessel, fuel and reflector sub-assemblies rotating plugs, steam generators, sodium piping and fuelling machines, were fabricated within the country, according to RRC scientists.

The FBTR is a sodium-cooled plutonium fuelled loop type fast reactor of 40 MW thermal and 13 MW nominal electrical power.

The first phase of the Indian nuclear power programme had started with the setting up of thermal nuclear reactors producing power from natural uranium.

In the second phase, plutonium produced from the thermal nuclear reactors is to be used in fast breeder reactors (FBR), to convert depleted uranium into more plutonium and also to convert thorium into uranium-233. The final phase involves breeder reactors, based on thorium cycle producing more uranium-233 than they burn.

The FBTR will provide the experience in the design, construction and operation of liquid metal cooled fast breeder reactors (LMFER) including power generation, and serve as an irradiation test bed for the development fuel, blanket and structural materials.

In addition valuable experience will be gained in LMFER technology pertaining to sodium pumps, sodium heat exchanges, fuel handling machines and control rod mechanisms.

Design and fabrication work have been also undertaken at the Bhaba Atomic Research Centre (BARC) for the manufacture of the mixed carbide fuel — plutonium carbide and uranium carbide.

The successful use of the Indian designed and fabricated fuel in FBTR would be of great significance to the country's future fast breeder reactor programme. This was because carbide fuel had better breeding capability and can lead to a much higher power growth rates than the conventionally used oxide fuel.

As the first phase of the breeder reactor programme, a beginning has rightly been made on the design of a prototype fast breeder reactor with a capacity of 500 MW.

CSO: 5150/0029

NUCLEAR POWER BOARD CHAIRMAN DISCUSSES REACTOR PLANS

Bombay THE TIMES OF INDIA in English 4 Jun 84 p 6

[Text]

BOMBAY, June 3.

FUTURE nuclear power stations in India will have a cluster of four reactors at a given site, according to Dr. M. R. Srinivasan, erstwhile director of the Power Project Engineering Division and first chairman of the Nuclear Power Board (NPB).

These reactors will have a standardised design. Major components and system engineering for all the reactors will be identical.

Speaking to this paper after his appointment as chairman of the board, Dr. Srinivasan said in the next 16 year, 12 reactors of 235 MW capacity (apart from Narora and Kakrapar) and 12 others of 500 MW capacity were proposed to be built in batches.

The NPB's aim would be to reduce the gestation period of projects which were delayed for want of supply of components by industries. With a large number of stations coming up at a given time, batch orders would be placed on the industries which could mass produce the components.

The board hoped to bring down the completion period for a power project to eight years from nine-and-a-half years, he said.

The formation of the NPB, which replaced the PPED, amounted to the "scaling up of management task" or "management restructuring with greater autonomy and operational powers" and these powers would pass down the line to various groups.

The board, as an integral organisation of the department of atomic energy, will be responsible for the design, construction, operation and maintenance of nuclear power stations. To fulfil this task, the authorised ceiling on expenditure is likely to be enhanced. This will empower the board to make costly procurements without going through the long-winding red-tape as happened under the previous set-up.

GROUP OF ENGINEERS

The Atomic Energy Commission, at its meeting this month, will approve the members to be appointed on the board and prescribe the financial and administrative powers.

The NPB, in future, may also be entrusted with the job of building and operating transmission lines after a string of nuclear power plants are set up.

A dedicated group of 50 engineers has been created to design and develop 500 MW nuclear reactors and this group will function from premises inside the BARC in the next 15 days. Mr. S. L. Kati, former director (engineering), PPED, is heading this group. Mr. M. H. P. Rao, project director, Madras Atomic Power Project, has since become director (engineering).

This exclusive group will design the reactor within a short time and the first 500 MW unit should not be looked upon as a prototype, according to Dr. Srinivasan. It only calls for a scale-up of components.

NO COMPARISON

No other sector of Indian industry faced the challenge of establishing self-reliance from the third project itself, as in the case of the MAPP, he said.

Setting up of steel plants, fertiliser plants or refineries in the country clearly showed that the transition towards self-reliance in these cases was "more gradual", Dr. Srinivasan pointed out.

The Atomic Energy Commission envisaged the country's first 200 MW nuclear power station at the same time when equipment for coal-fired power stations was being imported, that too in sizes of less than 100 MW.

India has now joined a select band of countries, namely the U.S., USSR, France, the U.K., West Germany, Canada, Japan and Sweden, which has the capacity to design, engineer, build and commision nuclear units on its own.

CSO: 5150/0025

AEC CHAIRMAN SPEAKS AT LABORATORY DEDICATION

Bombay THE TIMES OF INDIA in English 5 Jun 84 p 9

[Text] Bangalore, June 4 (UNI). India had become self-sufficient in uranium and heavy water, the atomic energy commission chairman, Dr Raja Ramanna said today.

Laying the foundation stone for the atomic minerals division (AMD) laboratory and housing complex in a six-hectare plot of Nagarabhavi, about 15 km from here, he stressed the need to step up exploration of atomic minerals, particularly uranium.

About 73,000 tonnes of indicated and inferred categories of uranium ores had been identified with the major part of the exploration efforts concentrated in the Singbhum thrust belt in Bihar and parts of Rajasthan. By and large, the grade of uranium ores present in the country was much lower than those elsewhere in the world.

He said uranium occurrences in Karnataka had now been established in Dakshina Kannada and Uttara Kannada districts, stretching for 165 km almost till the Goa border in the north and Mangalore in the south. There were three drilling prospects in this belt which were under exploration.

20 More Reactors

Dr Ramanna said import of uranium was not possible under the present international regulations. Keeping in view the country's power needs and the known uranium sources, a target of 10,000 MWE of nuclear power had been worked out for the end of the century.

Nuclear power contributed three percent of the total electrical capacity. Generation could reach ten percent with the proposed setting up of 20 power reactors in different parts of the country.

He said India's nuclear programme was modest compared to that of other industrialised countries. Quoting examples, he said the nuclear power capacity in the United States in 1983 was over 63,000 MWE, in France over 26,000 MWE, in Japan 19,000 MWE and the Soviet Union over 20,000 MWE. The world average was 12 percent and was expected to cross 23 percent by the end of the century.

Dr Ramanna said the Tarapur reactor was functioning steadily and the capacity factor was about 50 percent. The Kalpakkam unit near Madras operated at a power level of 200 MWE and reached 235 MWE after ensuring necessary safety measures.

The second Kalpakkam unit was expected to become operational--next year. Four of the five reactors in the country were functioning satisfactorily and had produced Rs 85 crores worth of electricity last year. They were expected to produce nearly Rs 10 crores worth of electricity a month during this year.

He said he was confident that the construction of power stations would not be unnecessarily delayed. The production of heavy water needed for power reactors would also be stepped up gradually. The Kota heavy water plant was expected to go into full production by October this year.

Deposits of Niobium-tantalum bearing minerals had been established in southern parts of Karnataka and Andhra Pradesh. Many other atomic mineral occurrences, including thorium, had come to light in parts of Andhra Pradesh, Tamil Nadu, Kerala and Karnataka and were being investigated.

The atomic minerals division director, Mr A.V. Pradke, said there was a need to establish a separate research and development wing to coordinate with the exploration work. The proposed AMD laboratory would cooperate with scientists and various universities to carry out research that would throw light on economic aspects of exploration.

Sophisticated methods like remote sensing and gamma ray spectrometric survey had been introduced in exploration operations, he said.

CSO: 5150/0026

OFFICIAL DISCUSSES PROBLEMS OF RAJASTHAN N-PLANT

Bombay THE TIMES OF INDIA in English 16 May 84 p 1

[Text] Bombay, May 15 (PTI). The 235-MW unit-I of the Rajasthan Atomic Power Plant (RAPP) shut down since long due to the heavy water leakage would be decommissioned if the snag could not be rectified, according to the chairman of the newly-constituted Atomic Energy Regulator Board (AERB), Prof A.K. De.

"We will not compromise on safety. Once we find that the leak cannot be plugged, we will shut down the plant," Prof. De said.

However, he said, plans were afoot to repair the reactor and recommission it before the year-end.

Prof. De who visited the RAPP a few days ago to study the problem said the leak was found to be in the metallic end-shield and it could be due to thermal stress, caused by the high temperature, inside the reactor.

"It can also be due to hydrogen embrittlement or entry of hydrogen atoms into the end-shield," he said.

Prof. De said the difficulty in plugging the leak was that it had to be done using only remote control methods because of the radiation inside the reactor.

Our Special Correspondent adds:

The leaks of expensive and scarce heavy water that have made the operation of RAPP-I impossible are due to hair-line cracks in the end-shield, a critical component of the reactor, DAE sources told THE TIMES OF INDIA.

The two cracks are about a tenth of a millimetre in width and about 25 m.m. long. Although their dimensions appear to be small, the fissures are large enough to ensure that irradiated heavy water, held under pressure in the reactor, gushes out from the end-shield in huge quantities.

The leaks result in depletion of the level of the "moderator" in the reactor, needed to slow down neutrons from fissioning natural uranium and sustain a controlled chain reaction at an optimal rate. They also lead to the spread of high levels of radioactivity and tritum contamination in the reactor building, thus creating an uncontrollable safety hazard.

The end-shield cracks were first detected in August 1981. DAE officials tried to seal them using zinc silicate. However, this effort, carried out in late 1981 to early 1982, failed. None of the subsequent efforts launched was to succeed either.

DAE engineers are now planning to seal them by using mechanical gasketed joints. They have already removed some of the hardware from the reactor, and taken out one lattice tube, a crucial component. They propose to remove two more lattice tubes before attempting the sealing joint. Although no firm dates have been specified, the operation is likely to take a few months.

/If the present effort fails, the DAE is unlikely to have any alternative but to scrap the entire reactor and one-half of the 440 MW power station altogether, say nuclear engineers. Besides safety and operational considerations, the possible decision to decommission the first unit of RAPP will also be made with an eye on the heavy water contained in the reactor. Its inventory of over 200 tonnes could be used in another nuclear power station to make up the big deficit of the nuclear material facing the DAE./ [in boldface]

RAPP-I was designed by the Canadians and built under their supervision. The unit cost Rs 73 crores or 76 percent more than originally estimated. It was commissioned in 1973, four years behind schedule.

Its cumulative capacity utilisation has been under 25 percent, and the unit has remained shut down for the best part of two years.

Components of the end-shield were supplied by the Canadians and assembled by BHEL at Bhopal. The failure of the end-shield was wholly unexpected, since the material was believed to be able to withstand thermal stress and other forms of fatigue or corrosion. The original design was subsequently modified in the subsequent series of reactors in Canada, but not in this country.

The end-shield was not the only part of RAPP-I to have failed. Coolant channels, in which the fuel is placed, are also known to have revealed, on removal and analysis, major instances of thermal fatigue and unbudgeted-for failure of metal. Another major problem is the fuelling machines.

Some nuclear engineers have in acknowledgement of the intractability of these problems proposed the use of different materials and designs.

However, this cannot be done in RAPP without scrapping and rebuilding large and vital parts of the reactor.

CSO: 5150/0024

BRIEFS

BHABHA REACTOR 'CRITICAL'--Vienna, June 6--An Indian nuclear reactor using a man-made uranium isotope, the only operational reactor of its kind in the world, has started fission operations, India's embassy to the International Atomic Energy Agency said yesterday, reports REUTER. It said in a statement that the reactor at the Bhabha Atomic Research Centre at Trombay, went "critical" (nuclear jargon for commencing fission operation) with 500 gm of U-233, a man-made isotope of uranium produced by the irradiation of the radioactive metallic element thorium. There were no complications, the statement said. India has five commercially-operating nuclear reactors, and five more are under construction. The embassy said India's long-term nuclear programme was expected to be based on U-233 conversion from thorium. India is a member of the Vienna-based IAEA, a United Nations agency set up in 1957 to promote peaceful uses of nuclear energy and to foster the exchange of nuclear know-how for peaceful purposes. [Text] [Calcutta THE STATESMAN in English 7 Jun 84 p 5]

LIGHT WATER REACTORS--India will purchase two light water reactors (LWR) from the Soviet Union if the terms offered are acceptable, according to the Department of Atomic Energy (DAE), reports PTI. A DAE spokesman said there is no intention to abandon the pressurised heavy water reactor system (PHWRS) developed in India nor is there any plan "to develop light water reactors on our own." He said if some reactors are obtained from the Soviet Union they will only supplement the national line of PHWRS." The spokesman said since there is an acute shortage of power in the country, the DAE may consider building a small number of Soviet designed LWRS, "if the terms offered by the Soviet Union are acceptable." Regarding India's ability to operate LWR systems, the spokesman said there is sufficient experience from operating the Tarapur reactors which are of the light water type. He said even a small country like South Korea is operating successfully both light and heavy water reactors. According to DAE, the proven uranium reserves in India can only support a 10,000 megawatt natural uranium reactor programme. And the cost of nuclear power, allowing for the production cost of heavy water, "turns out to be competitive with power from coal in our conditions." [Text] [New Delhi PATRIOT in English 7 Jun 84 p 5]

NATURAL FUEL CYCLE TESTED--The natural fuel cycle has been successfully completed in the country. Only a few advanced nations have achieved this. The director of the Bhabha atomic research centre, Dr (Ayengar), gave this information to PTI in Bombay. Completion of fuel cycle is a sophisticated and lengthy process involving various stages. These include preparation of fuel elements and assembly for use in a reactor, burning the fuel in the reactor, recovering the radioactive byproducts from spent fuel and reprocessing the remaining fissionable material into new fuel elements. Dr (Ayengar) also said that the 100-mw Dhruva reactor designed and built indigenously to produce large quantities of isotopes will be commissioned in September. [Text] [Delhi Domestic Service in English 15 Jul 84]

CSO: 5100/4736

BRIEFS

NEW POWER PLANT OPERATION--The new power station of the Electric Company the construction of which was begun on the ZAA site south of Ashqelon, will be the country's first to be operated in two shifts: it will be possible to shut down the production units totally at night when demand for electricity in the economy drops and to activate them again in the morning without damaging their functioning. Manager of the planning branch for power plants in the Company, Moshe Katz, reported that in the southern station--in which two coal units will be constructed, (each of 550 Megawatts), which will be the largest power units in the electrical production system--a series of technical innovations will be introduced. In contrast to the power stations which have been constructed until now in Israel, whose power units are basic units requiring continuous operation during all hours of the day, the new power station can also function in two shifts, and this capability will increase the flexibility of the system for producing electricity--something that will make possible optimal utilization of the large units that produce electricity from coal during hours of a demand load while preserving the integrity of supply. The manager of the branch further reported to the power station planning branch that in the southern station a new computerized system will be installed that will assure accurate operation and maximum utilization. This is meant to enable the Electric Company to increase significantly the production of electricity from coal and to lessen the cost of production. According to the plan, construction of the first unit will be completed in 1989 and the second in 1990. There will be invested in the construction of the new power station the sum of some $900 million, including interest for the period of construction. This sum does not include the investment in the system which will pulverize the coal. /Text/ /Tel Aviv HA'ARETZ in Hebre 23 May 84 p 7/ 8090

CSO: 5100/4506

COMMENTARY CRITICAL OF SENATOR CRANSTON'S ALLEGED ANTI-PAKISTAN STAND

Islamabad THE MUSLIM in English 30 Jun 84 p 4

[Article in the "Spectrum" column by Khalid Akhtar: "Senator Cranston's Nuclear Blackmail"]

[Text] It is again Pakistan's nuclear programme--the bogey being raised, as has been the pattern, at an appropriate time. With the Presidential elections hardly five months away the Reagan administration would not like to confront the powerful pro-Israel and pro-India lobbies represented by Senator Cranston and his associates on an issue that has remained 'selectively sensitive' for the electorate there. A nuclear Israel or a nuclear India are not seen as a threat to non-proliferation but acquisition of even peaceful nuclear technology by a country like Pakistan is viewed with grave apprehensions.

This is not the first time that Senator Cranston has endeavoured to deprive Pakistan of all U.S. assistance on the nuclear issue. His numerous similar moves on the subject have been defeated in the past. But steadfast as he appears to be, each time he has picked up new 'evidence' with all the enthusiasm in support of his cause. First it was alleged that Pakistan was producing an 'Islamic bomb' with Libyan assistance. Now 'Chinese collaboration' is being widely circulated as a strong enough evidence to penalise Pakistan on the issue. All these canards have been based on the CIA's findings. These sketchy reports appear to be queer. As a matter of fact a highly efficient intelligence agency, like the CIA was expected to be more consistent in its findings on Pakistan's nuclear programme, as it has been in many other cases. CIA's lapses seem to be too often deliberate--on each occasion providing the administration with the execuse to browbeat Pakistan for a variety of reasons--not necessarily nuclear.

Dichotomy

Mr. Cranston and his associates love for peace is laudable. But ironically he sees no threat to world peace in the expansionist policies of Israel and India. Israel will use the nuclear device, if it has to, to keep the Arab world subdued. Any Arab uprising against Israel will prove this point one day. But inexplicably, Mr. Cranston's concern appears to be to stop the nonexistent nuclear threat to Israel and India. A disastrous concept that nuclear weapons are safe in the hands of hegemonistic and strong states seems to be developing

in the West. It is like imposing peace by the strong on the weak through coercion, a sad way of directing the affairs of the world.

This monopolistic apprach by the West has made the nuclear field a prohibited domain for the 'undesirables' and anyone daring to violate the restriction has invariably felt the 'heavy hand'. In case of Iraq the punishment was swift and devastating when its nuclear installations were razed to the ground by the Zionist planes. It is unthinkable that such an operation could have been carried out without the consent of the United States. Pakistan has also too often felt the 'pinch' of the U.S. pressure.

Now what are the prospects of China's collaboration with Pakistan in the nuclear field. In the first place the two countries are not in collusion in pursuit of any joint regional ambition which could lead to their sharing of information in a sensitive field like nuclear technology. The knowledge of nuclear sciences is too precious to be traded away in return for small gains. The United States and Israel, on the other hand, do have a joint regional programme and this has made their collaboration in a way a unique one.

Secondly, no other country needs more badly to keep the Sub Continent denuclearised than China. For it will be bhina which will feel most of the heat of any nuclear holocaust in the Sub-Continent.

Inconclusive Evidence

In his briefing to Congressional aides on the Capital Hill recently William Brown, the American Deputy Assistant Secretary of State said "the information about exactly what help the Chinese were providing Pakistan in the nuclear technology was not 'conclusive' and there could be a satisfactory explanation". The most intriguing part of his statement was that "certain activities were going on between China and Pakistan and that the two nations were being asked through the diplomatic channels about the nature of these contacts."

China has already made its position clear on the issue when Prime Minister Mr. Zhao said: "we by no mean favour nuclear proliferation nor do we engage in such proliferation by helping other countries to develop nuclear weapons. This stand was later reiterated by the National People's Congress and the Foreign Ministry. The Chinese position is bound to be accepted for three reasons In the first place, as already pointed out, there are no grounds for nuclear collaboration between Pakistan and China (No. 2), the nuclear deal between China and the U.S. involves billion of dollars and Washington would not like to write off this handsome bargain, and finally very close ties with China is America's No. 1 political necessity and the White House would not like trivial issues to stand in way of newly developing friendship between a capitalist and socialist country.

It is for Pakistan that the nightmare appears to be unending.

The recent campaign can well be taken as a broadening of efforts to make Pakistan sign the Non-Proliferation Treaty--something which India has also not done but has been spared the adverse international reaction, Mr. Ejaz

Azim, Pakistan's envoy to Washington, met Mr. Richard Murphy, the U.S. Assistant Secretary of State on Wednesday last and reiterated Islamabad's opt- repeated position that it has no intention of producing the atom bomb. But it is doubted that as in the past this assurance will carry any weight in the Capital Hill. Perhaps Pakistan has remained too defensive to be convincing on the issue. More firmness and steadfastness is needed to meet the challenge of Mr. Cranston and his associates.

CSO: 5100/4735

BRIEFS

CANADIAN AID RULED OUT--Canada has ruled out nuclear assistance to Pakistan. This was stated by the Canadian deputy foreign minister at Islamabad before leaving for Nepal. He said Pakistan does not fulfill the preconditions set by Canada for cooperation in the nuclear field. [Text] [BK181316 Delhi Domestic Service in English 1230 GMT 18 Jul 84]

CSO: 5100/4737

BRIEFS

RADIOACTIVE WASTE--The Assembly--The Prime Minister, Mr P.W. Botha, stated yesterday that it was not the Government's policy to allow the storage of radio-active waste from abroad in either South Africa or South West Africa. Speaking in reply to a question in Parliament by Mr Brian Goodall, the Opposition's chief spokesman on energy matters, Mr Botha confirmed that since 1979 a number of enquiries had been received from "certain instances and individuals originating from a number of European countries" regarding possible radio-active waste dumps in SWA. "When these offers were received they were referred to and considered by the then Atomic Energy Board (now the Atomic Energy Corporation). These offers were declined," Mr Botha said. Mr Goodall's question followed reports last month that offers of around R1 000-million had been made to dump nuclear waste from Germany and the United States in SWA. The issue was mentioned publically for the first time by the member of the Executive Council for Finance, Mr Jannie de Wet, in the territory's white assembly. Mr De Wet urged that the offer be considered and not rejected out of hand. He pointed out that the amount mentioned constituted almost the total SWA annual budget. [Text] [Johannesburg RAND DAILY MAIL in English 5 Jul 84 p 6]

CSO: 5100/47

PROSPECTS FOR NUCLEAR COOPERATION WITH LIBYA

Brussels KNACK in Dutch 30 May 84 p 28

[Article by Karel Cambien: "Qadhdhafi's Gift"]

[Text] Libya is offering our country an interesting nuclear contract. A windfall for the industry, but politically this affair isn't so simple.

The whole nuclear industry is certainly in agreement about one thing: These aren't good times for getting big foreign contracts. For quite a few countries have cut back their national programs for building nuclear power plants. It was a stroke of good fortune when they decided in mid-April to take part in the French Chooz power plant, otherwise they might have pretty much continued sitting around idle.

Still, this sector is living on a mountain of hope. Egypt has been saying for some time that it's a potential client, but that country has the unspeakably great disadvantage of having been rated as not very solvent by all Belgian and international financial agencies. Turkey and Pakistan should also be possible candidates for buying one or more nuclear power plants, but the competition already seems to be a full step ahead in those two markets. But Libya? To judge by the reports that were eagerly spread around by the Libyans themselves in the first place, there's a pretty good chance.

People generally expected that the Libyan nuclear contract was going to come to the cabinet council by the end of last week, but they left one important factor out of their calculations. The cabinet for Foreign Trade, which--let us say--really hasn't taken this business up at all, was still busy studying a file, the complexity of which cannot be doubted. Whoever says Libya, thinks Qadhdhafi, and with this name it's very easy, and often justifiably so, to make the connection with international terrorism. In short: Qadhdhafi and Libya form a special sore point. If this affair is presently going to be under discussion at the highest levels, one can expect Minister of Justice Jean Gol, who--as is sufficiently well known--loyally defends the Jewish interests in our country, to firmly put his foot on the brakes.

Yet viewed purely objectively, there isn't as much reason for this as it would seem at first sight. Actually, what it come down to is that Libya has followed

the rules for what Belgium demands for delivering nuclear power plants to third-world countries. Qadhdhafi's country signed the non-proliferation treaty in 1976 and is also a member of the IAEA [International Atomic Energy Agency] based in Vienna. In any event, one has already received the formal assurance from Vienna that up to now Libya has always observed the relevant requirements.

Consortium

The possible conclusion of a contract with Libya has just now been made public, but the diplomatic offensive preceeding this reaches back over a couple years now. Libya--and this is what it's all about--wants, in the first place, to conclude an agreement for economic, industrial and technological cooperation with our country. At the beginning of last week, a preliminary agreement between Belgium and Libya was concluded at the official level, the first of its kind. Only within the framework of a final cooperation agreement, however, can a place be made for a nuclear, or other economic, opening. The Libyans would like to see that sort of cooperation agreement signed during the upcoming month of July; only then will it really be possible to also unproblematically discuss a nuclear cooperation.

For that matter, nuclear cooperation in itself is saying too much. The Libyans, who would build two 400-megawatt nuclear power plants at the head of the Gulf of Sirte, will be getting the so-called nuclear reactor, the actual heart of the power plant, from the Soviet Union. For the construction of what, strictly considered, is the /non-nuclear/ part, our country, among others, is being considered. For the Soviets seemed too expensive for the entire construction of these power plants. Up to now, the value the Belgian contract may have has been grossly exaggerated. People have spoken of a contract for 60 to 70 billion francs. It's certainly obvious that our country would truly like to have that contract, but would rather share the risk that comes along with it. Past experience has shown that spreading the risk and acting in a consortium is a more suitable way of doing things, as Maurice Schollaert, the driving force behind the cabinet for foreign trade, has also acutely underscored. A more realistic estimate of the contract's value lies around ten billion, which still adds up to a nice thing for the Belgian nuclear industry, and first and foremost for Belgonucleaire which still suffered losses last year.

It's no coincidence that Belgium is being approached by Libya. A study just published by the IAEA in Vienna points out that our country belongs at the top of the list world-wide as far as nuclear power plant production is concerned. Our nuclear industry truly enjoys the fame and reputation, qua safety control, of offering the best in the world, better than France even. Furthermore, Belgonucleaire has already been represented in Tripoli for nearly a decade now, as an advisor for several, for the time being small-scale nuclear projects. For Libya itself, our country also has above all the advantage of being small, and so less involved in the matter of ideological East-West conflict.

It is above all important to place this possible nuclear contract in a broader context. An agreement between Libya and Belgium on economic, industrial and technological cooperation would, apart from the possible political implications,

above all greatly benefit our country. It can be seen from the statistics that Libya sells a very large amount of oil here, but that our country exports next to nothing to Qadhdhafi's country. The balance of trade between the two countries thus shows a frightful imbalance of roughly thirty billion, in Libya's favor.

Tripoli has now definitely made known its intention to cooperate in eliminating this imbalance, and so open the door to Belgian industry of whatever sector. It's certain that not only Belgonucleaire--with Acec, Cockerill Mechanical Industries and the rest in train--but also a bunch of others will profit from this. In this connection, Bell Telephone, for example, has also been explicitly mentioned. It's just that Qadhdhafi's followers want to force rapid decisions from their Belgian interlocutors, and precisely that promises to be not so simple. Abroad, people stand ready to once again jump into the breach.

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PARLIAMENT REJECTS MOTION AGAINST NUCLEAR POWER

The Hague ANP NEWS BULLETIN in English 30 Jun 84 p 1

[Text] The Hague, June 29--The second chamber of parliament last night thwarted an opposition attempt to nip in the bud any government activity which could be construed as furthering the cause of nuclear power generation in the Netherlands.

The two government coalition parties--CDA and VVD--supported by the small right wing parties threw out a Labour-sponsored motion seeking to curtail the government's freedom of action.

The motion, submitted by Labour member Kees Zijlstra, sought to restrain the government pending a second chamber debate on the question whether or not more nuclear power stations should be built in the Netherlands.

It was backed by the entire left-wing block made up by the Labour, radical PPR, D'66, EVP, CPN and PSP parties.

Nuclear power generation is now confined to a 450-megawatt commercial station at Borssele in the southwest of the country and a 50-megawatt experimental plant at Dodewaard in central Holland.

Summer Recess

The second chamber is to debate the question after parliament's summer recess, which started today. The first plenary debate after the recess is scheduled for August 27.

The debate will be held on the basis of a final report to be submitted by a government-appointed committee which guided a two-year public debate on the issue.

In an interim report after the public debate, in which 42,000 people took part, the committee early this year came out against the erection of more nuclear power stations.

The cabinet has not yet taken a stand on the issue.

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COUNCIL ADVISES EXPANSION OF NUCLEAR POWER

The Hague ANP NEWS BULLETIN in English 6 Jul 84 pp 2-3

[Text] The Hague, July 5--The Netherlands needs to build more nuclear power stations to meet its energy needs by the turn of the century, a senior government advisory body said today.

In a report to Economic Affairs Minister Gijs van Aardenne, an 11-6 majority of the General Energy Council (AER) calls for major investments in new Dutch nuclear power stations.

The report has been drawn up to help state government policy on future electricity production.

It opposes the recommendations of the De Brauw commission, which advised in January, after a costly two-year public debate, that no new nuclear power stations should be built.

The AER members in favour of nuclear power said the government should make a clear statement that nuclear energy is acceptable and could then start making preparations for the erection of one or more nuclear power plants.

In doing so the government should call tenders, study siting and waste problems and look into industrial effects, the report said.

Investment Decisions

Decisions on major investments should be taken during the next two years, it said, basing its conclusion on average estimates of demand for electricity, and on an average estimated economic growth of one per cent per year.

The council considered possibilities for alternative methods of electricity production, but came to the conclusion that either the economic outlook for them was unfavourable, or that there were too many other constraints on their development.

The report said that of the 14 Dutch power stations which did not rule out use of uranium, 11 felt that the Netherlands should now opt for nuclear energy, and all 14 felt that coal and gas already played a more than adequate role in Dutch electricity production.

The council majority felt that construction of new nuclear power stations would contribute to a policy of diversification, which would spread the 'unavoidable' risks in the energy sector.

Of the opponents on the council, three rejected nuclear energy outright, and three felt that, while use of uranium should be considered, there should be a two-year delay before decisions on investments were made.

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END